OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **SEBBINS POND** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *slightly worsening* trend overall, but there has been a period of stability since 1996. Residents complained of a possible bloom in May. July's chlorophyll concentration was indicative of a severe algae bloom. The phosphorus concentrations were high in the hypolimnion and most likely caused the algae bloom. June and August chlorophyll concentrations were lower for the pond, yet still above the NH mean reference line. The most dominant alga in June was the dinoflagellate *Ceratium*, and the total phytoplankton abundance was high. Residents might want to consider sampling in May, and also taking plankton samples during all sampling sessions. This will help us to identify and track the nuisance algae species in the pond. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *fairly stable* trend in lake transparency. Water clarity in June was low, but recovered in July and August. The high chlorophyll concentrations in July did not seem to affect the Secchi disk reading. It is possible that the algae were at a depth in the pond below 3 meters, and therefore would not have interfered with the Secchi disk reading. Mean transparency values are still below the state mean. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be

slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stable* trend in the upper water layer, and an *improving* trend in the lower water layer. Epilimnetic phosphorus concentrations increased slightly this season possibly as a result of the increase in rain, and therefore, an increase in watershed runoff to the pond. The hypolimnetic phosphorus concentration was elevated in July as a result of the depletion of dissolved oxygen at this depth. August results were the lowest ever experienced in one month for the pond, and mean phosphorus concentrations in the hypolimnion reached an all time low! We hope to see this trend continue in Sebbins Pond. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- Dissolved oxygen was low in the bottom 3 meters of the pond in June (Table 9). As oxygen is depleted in the lower water layer, phosphorus bound to the sediments is released into the water column and provides an internal source of phosphorus to the pond. This can cause excess algal growth. Since an internal source of phosphorus to the lake is present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection.

- The Back Pond sampling site had a high total phosphorus concentration in June (Table 8). The rains that were commonplace in the early part of June may have caused this increased result. The phosphorus concentrations throughout the Sebbins Pond watershed continue to be high. The Outlet did not have the high result that was observed in August of last year.

NOTES

- Monitor's Note (6/16/00): Residents complained about clumps of algae about 1 month ago.

- Biologist's Note (6/16/00): Algae identified as *Mougeotia* (filamentous green algae), *Tabellaria* (a diatom), and pine pollen. Internal loading in hypolimnion.

USEFUL RESOURCES

Stormwater Management and Erosion and Sediment Control Handbook. NHDES, Rockingham County Conservation District, USDA Natural Resource Conservation Service, 1992. (603) 679-2790.

Comprehensive Shoreland Protection Act, RSA 483-B, WD-BB-35, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

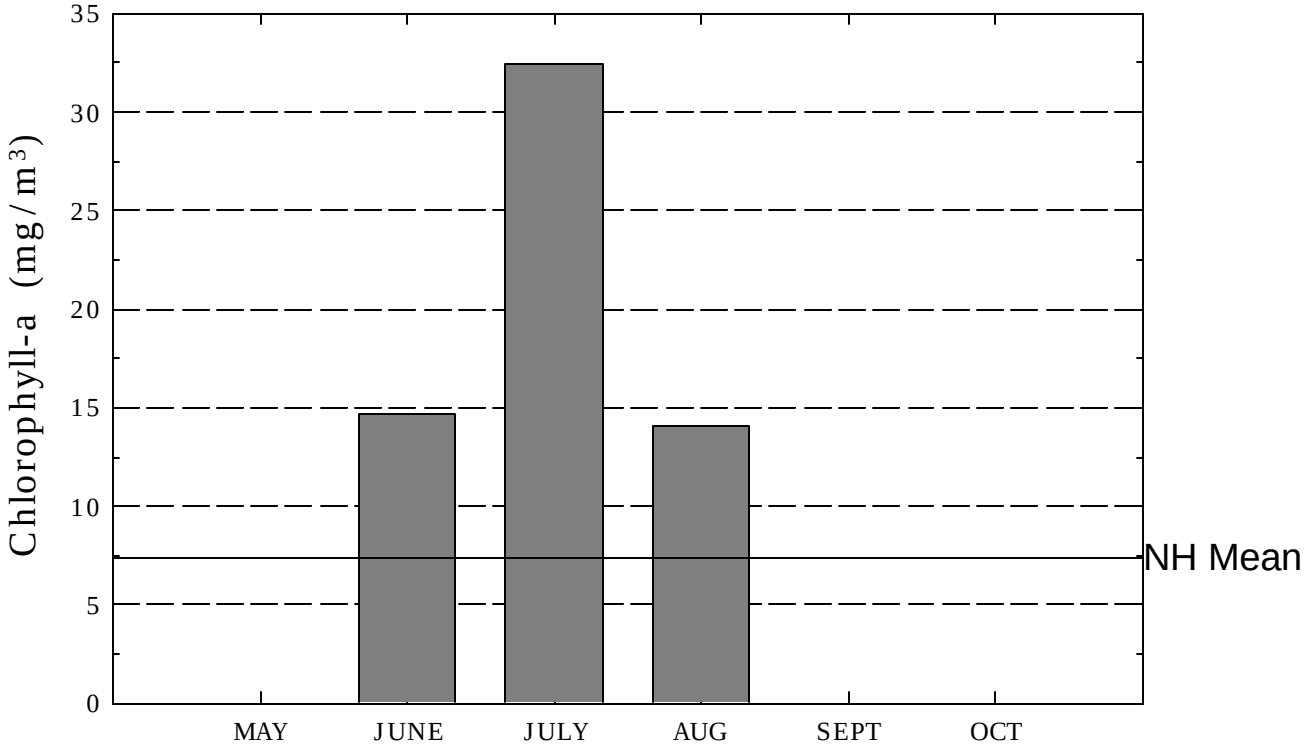
Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

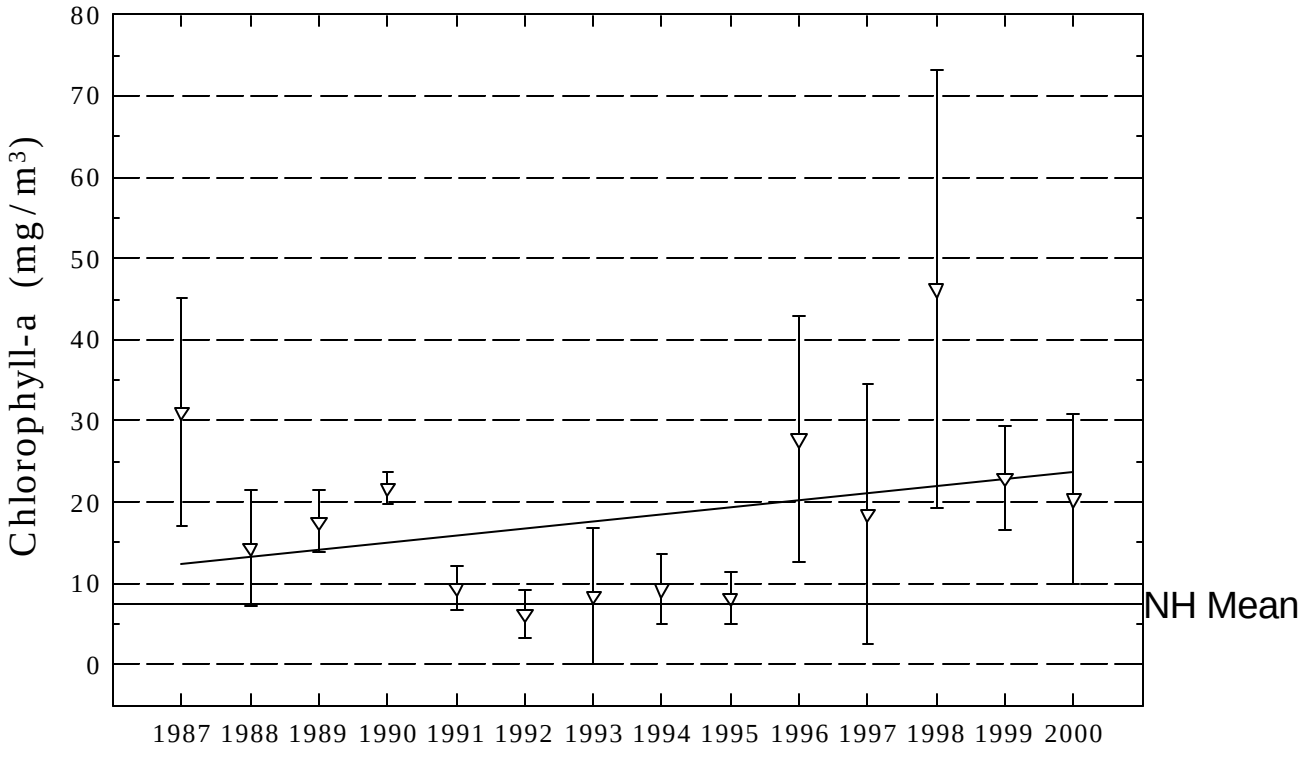
Nonpoint Source Pollution and Stormwater Fact Sheet Package. Terrene Institute. (800) 726-5253, or www.terrene.org

Sebbins Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



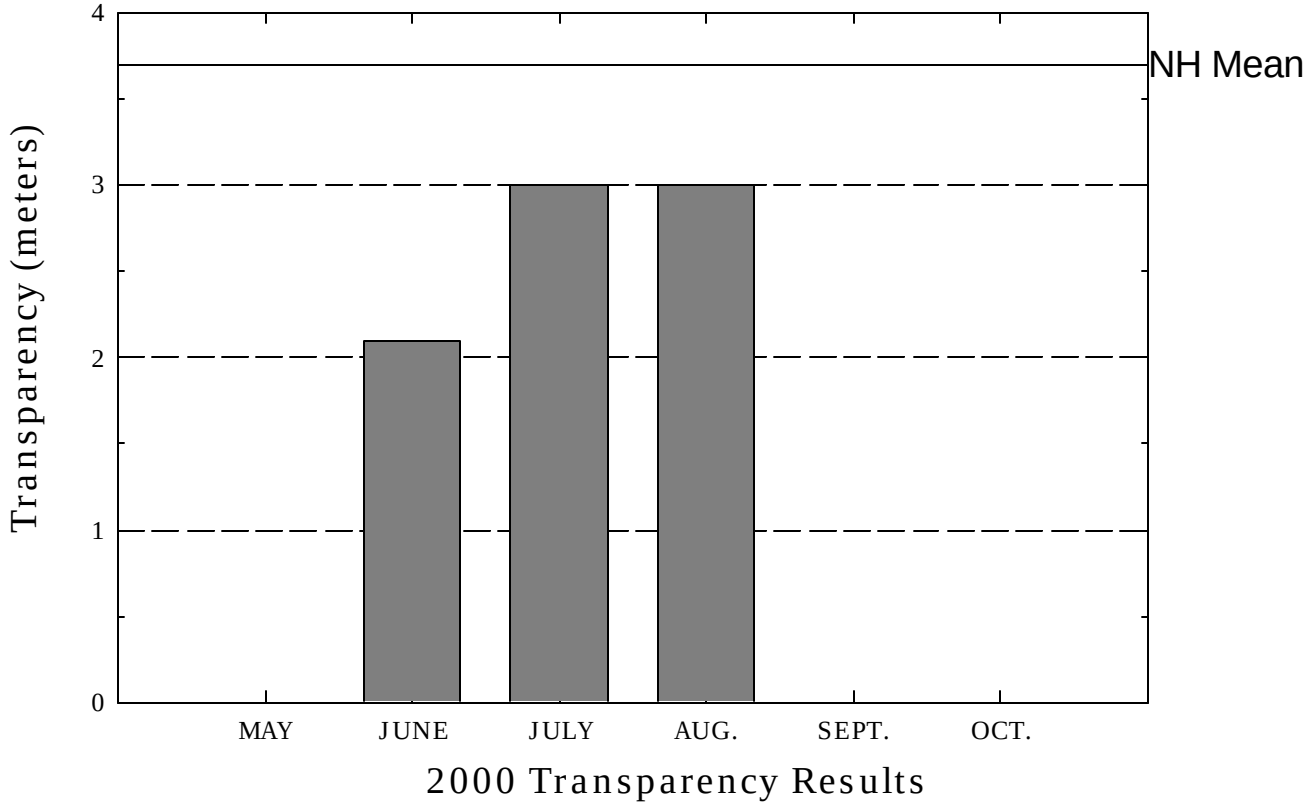
2000 Chlorophyll-a Results

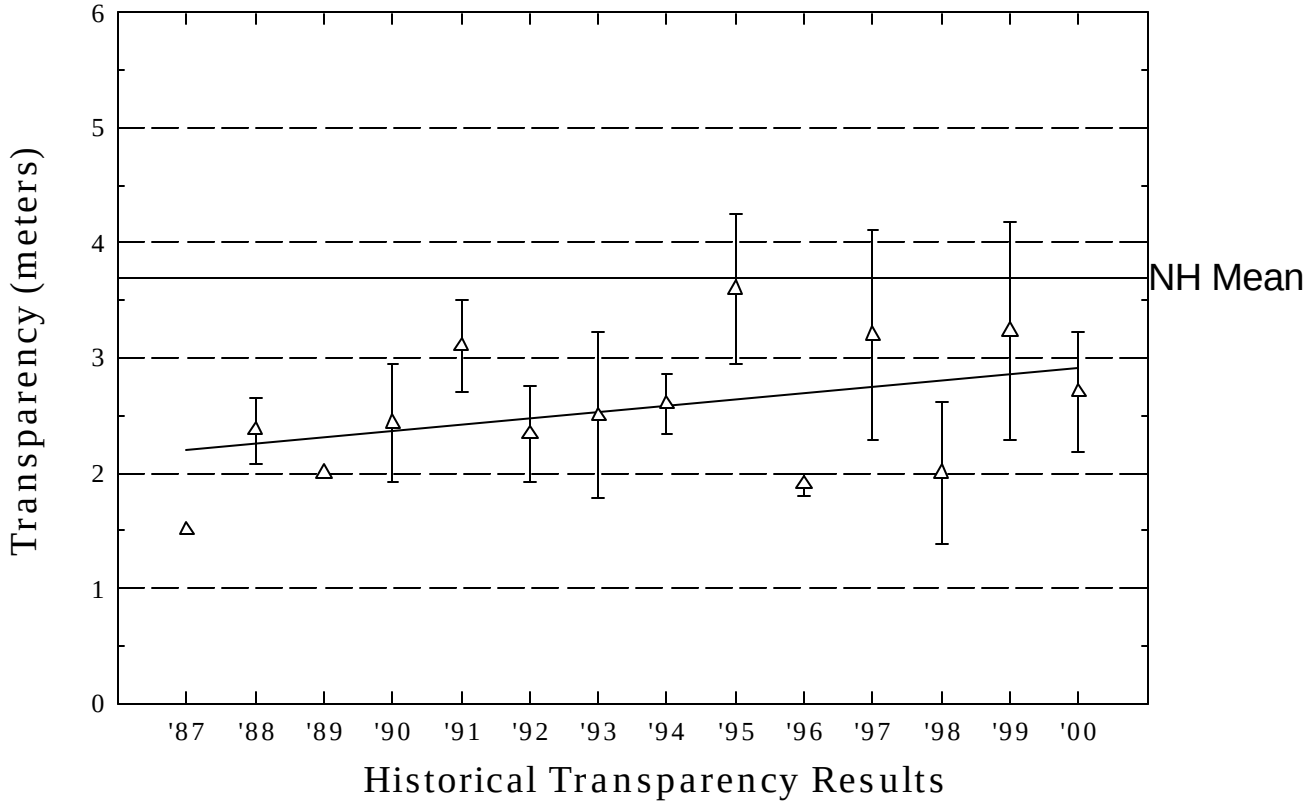


Historical Chlorophyll-a Results

Sebbins Pond

Figure 2. Monthly and Historical Transparency Results





Sebbins Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

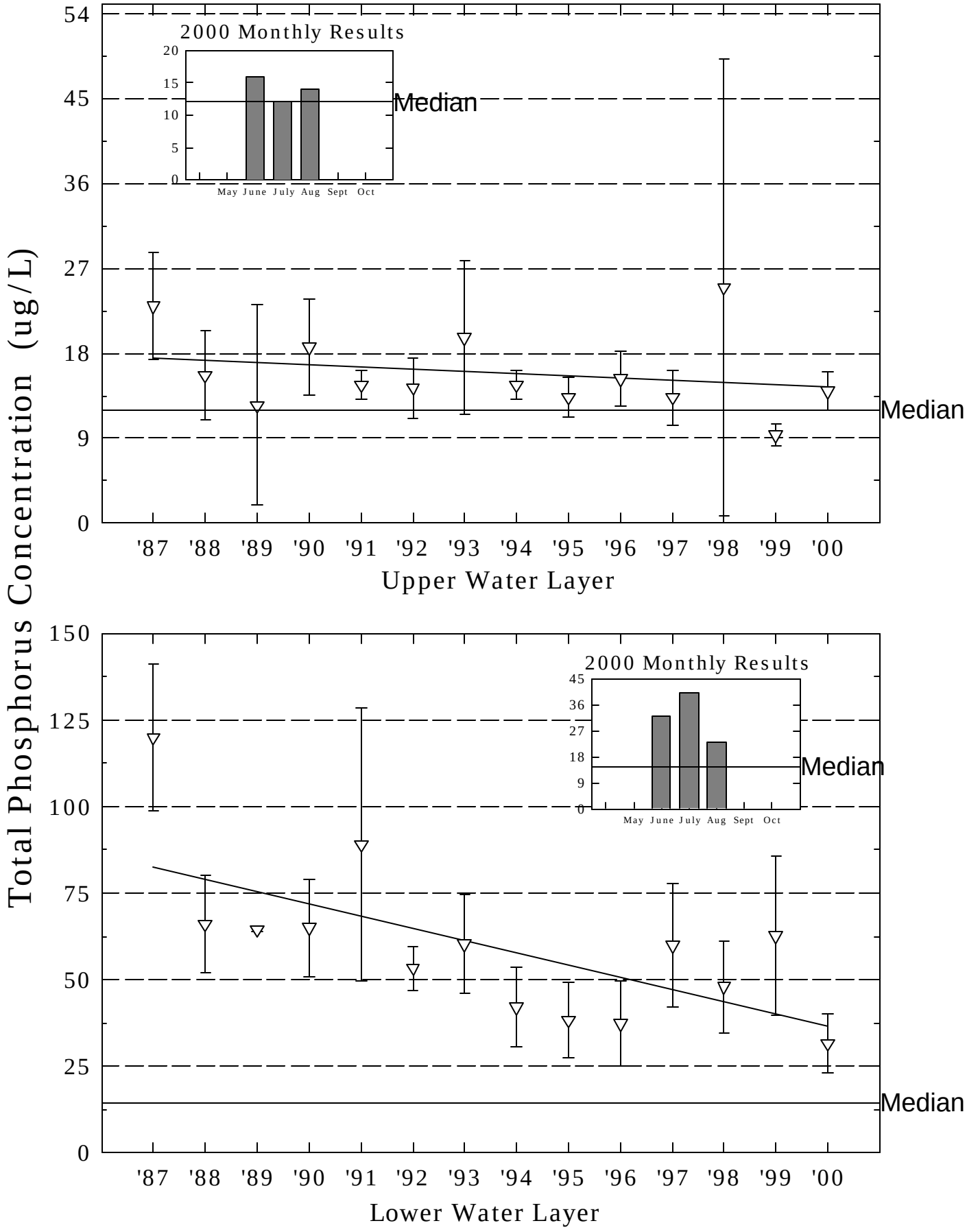


Table 1.

SEBBINS POND

BEDFORD

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1987	21.18	41.09	31.13
1988	10.17	22.68	14.37
1989	13.68	20.29	16.28
1990	20.43	23.17	21.80
1991	6.90	12.20	9.41
1992	3.87	9.57	6.23
1993	0.55	17.23	8.36
1994	5.40	13.90	9.34
1995	4.91	11.31	8.28
1996	11.12	40.93	27.76
1997	8.66	36.98	18.55
1998	15.68	67.23	46.24
1999	9.74	30.34	19.61
2000	14.10	32.43	20.39

Table 2.

SEBBINS POND

BEDFORD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
07/10/1987	CERATIUM	51
	ASTERIONELLA	44
06/24/1988	ASTERIONELLA	57
	CERATIUM	40
06/09/1989	ASTERIONELLA	42
	COELOSPHAERIUM	
	CERATIUM	
06/22/1990	OSCILLATORIA	46
	COELOSPHAERUIM	36
06/14/1991	FRAGILARIA	52
	CERATIUM	28
06/19/1992	CERATIUM	50
	FRAGILARIA	41
	ANABAENA	6
08/21/1992	CERATIUM	96
	DINOBRYON	1
06/11/1993	FRAGILARIA	42
	CERATIUM	30
06/24/1994	RHIZOSOLENIA	43
	ASTERIONELLA	27
	CERATIUM	17
06/16/1995	ANABAENA	42
	CERATIUM	19
	FRAGILARIA	16
06/14/1996	CERATIUM	85
	RHIZOSOLENIA	10
	ASTERIONELLA	4

Table 2.

SEBBINS POND

BEDFORD

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06/13/1997	CERATIUM	77
	MALLOMONAS	6
06/18/1999	CERATIUM	40
	DINOBRYON	15
	FRAGILARIA	13
06/16/2000	CERATIUM	59
	MALLOMONAS	37
	ASTERIONELLA	3

Table 3.

SEBBINS POND

BEDFORD

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1987	1.5	1.5	1.5
1988	2.2	2.7	2.3
1989	2.0	2.1	2.0
1990	2.0	3.0	2.4
1991	2.7	3.5	3.1
1992	2.0	2.8	2.3
1993	1.9	3.3	2.5
1994	2.3	2.8	2.6
1995	3.0	4.3	3.6
1996	1.8	2.0	1.9
1997	2.2	4.0	3.2
1998	1.5	2.7	2.0
1999	2.3	4.2	3.4
2000	2.1	3.0	2.7

Table 4.

SEBBINS POND

BEDFORD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
BACK POND				
	1987	6.65	7.11	6.82
	1988	6.33	6.33	6.33
	1990	6.72	7.27	6.88
	1991	6.30	7.15	6.66
	1992	4.47	7.26	4.95
	1993	7.01	7.26	7.10
	1994	6.75	7.11	6.84
	1995	6.97	7.27	7.06
	1996	6.21	6.63	6.42
	1997	6.82	6.95	6.87
	1998	6.45	7.02	6.71
	1999	6.68	7.30	6.82
	2000	6.33	7.12	6.53
COVE INLET				
	1989	6.40	6.59	6.47
EPILIMNION				
	1987	7.36	7.51	7.43
	1988	6.75	7.45	6.97
	1989	6.93	7.50	7.20
	1990	7.33	7.68	7.48
	1991	7.13	7.40	7.29
	1992	7.44	7.66	7.57
	1993	7.46	7.56	7.51
	1994	7.22	8.51	7.48

Table 4.

SEBBINS POND

BEDFORD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1995	7.21	7.28	7.24
	1996	6.80	7.25	6.98
	1997	7.11	7.50	7.23
	1998	6.81	7.16	6.99
	1999	6.97	8.13	7.14
	2000	6.95	7.30	7.09
HYPOLIMNION				
	1987	6.30	6.47	6.38
	1988	6.20	6.40	6.28
	1989	6.21	6.54	6.40
	1990	6.30	6.37	6.34
	1991	6.31	6.70	6.50
	1992	6.44	6.67	6.53
	1993	6.36	6.45	6.39
	1994	6.26	6.38	6.30
	1995	6.47	6.78	6.59
	1996	6.31	6.37	6.35
	1997	6.42	6.53	6.47
	1998	6.20	6.35	6.28
	1999	6.41	6.73	6.58
	2000	6.30	6.46	6.35
METALIMNION				
	1987	6.41	6.58	6.49
	1988	6.57	7.40	6.81
	1989	6.74	7.78	6.93
	1990	6.53	7.48	6.80

Table 4.

SEBBINS POND

BEDFORD

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1991	7.00	7.40	7.14
	1992	7.36	8.07	7.52
	1994	6.66	7.77	6.89
	1995	6.72	7.50	6.97
	1996	6.55	7.03	6.76
	1997	6.70	7.18	6.93
	1998	6.20	6.55	6.31
	1999	6.89	7.79	7.06
OUTLET				
	1987	7.23	7.89	7.44
	1988	6.86	7.67	7.05
	1989	6.92	7.51	7.20
	1990	7.24	8.56	7.52
	1991	7.21	7.70	7.36
	1992	7.47	7.68	7.53
	1993	7.56	7.64	7.60
	1994	7.13	8.56	7.38
	1995	7.17	7.26	7.22
	1996	6.84	7.38	6.97
	1997	7.12	7.39	7.25
	1998	6.20	7.19	6.56
	1999	7.08	7.83	7.29
	2000	0.00	7.01	7.17

Table 5.

SEBBINS POND

BEDFORD

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1987	13.30	13.30	13.30
1988	9.60	16.00	13.50
1989	14.10	14.50	14.30
1990	13.30	14.80	14.17
1991	12.60	14.50	13.80
1992	13.77	16.30	14.89
1993	14.70	17.40	16.00
1994	9.50	18.70	14.40
1995	16.60	18.70	17.90
1996	13.40	14.70	14.00
1997	14.00	15.70	14.67
1998	13.40	15.20	14.03
1999	15.00	16.90	16.08
2000	13.00	14.00	13.37

Table 6.

SEBBINS POND

BEDFORD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
BACK POND				
	1987	128.0	144.5	136.3
	1988	119.6	119.6	119.6
	1990	129.7	154.9	140.1
	1991	122.7	162.4	147.0
	1992	145.1	151.3	148.1
	1993	154.1	176.4	168.6
	1994	167.6	174.9	170.6
	1995	168.9	174.3	171.3
	1996	133.9	176.5	152.8
	1997	165.6	181.7	174.7
	1998	159.9	194.0	172.2
	1999	191.4	199.8	196.0
	2000	151.4	184.3	172.1
COVE INLET				
	1989	113.6	123.7	117.1
EPILIMNION				
	1987	137.7	146.9	142.3
	1988	133.6	140.6	138.2
	1989	137.7	142.9	140.1
	1990	149.1	157.8	152.4
	1991	153.1	160.5	157.7
	1992	157.4	162.5	159.5
	1993	164.3	173.1	169.8
	1994	167.3	174.2	171.0

Table 6.

SEBBINS POND

BEDFORD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1995	165.7	171.8	169.4
	1996	164.5	176.9	169.1
	1997	169.8	177.7	174.6
	1998	157.0	186.5	172.0
	1999	190.4	195.0	192.0
	2000	189.8	200.0	195.2
HYPOLIMNION				
	1987	144.5	154.8	149.6
	1988	139.8	147.5	144.6
	1989	142.4	170.8	157.3
	1990	147.9	160.7	153.7
	1991	152.2	202.8	177.3
	1992	156.5	165.5	160.0
	1993	170.2	178.7	174.3
	1994	164.0	168.2	166.0
	1995	163.3	164.7	163.9
	1996	165.5	167.5	166.5
	1997	162.1	166.4	164.7
	1998	174.6	185.6	180.6
	1999	182.4	190.9	186.6
	2000	188.5	191.1	190.0
METALIMNION				
	1987	130.3	135.1	132.7
	1988	137.2	141.1	139.7
	1989	139.0	145.4	141.9

Table 6.

SEBBINS POND

BEDFORD

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1990	144.0	149.4	147.2
	1991	152.9	403.0	236.7
	1992	156.2	159.9	158.1
	1994	159.3	169.4	165.0
	1995	164.0	171.9	168.0
	1996	160.5	176.3	167.0
	1997	164.3	174.4	170.5
	1998	165.1	168.3	167.2
	1999	182.9	191.0	187.6
OUTLET				
	1987	137.3	144.4	140.8
	1988	137.7	141.5	139.7
	1989	136.3	140.7	138.7
	1990	148.5	156.1	151.4
	1991	142.6	162.9	156.0
	1992	160.1	162.0	161.0
	1993	163.6	173.8	170.0
	1994	166.4	172.4	169.1
	1995	165.9	176.3	171.1
	1996	163.4	175.7	168.2
	1997	169.3	178.6	174.9
	1998	109.8	188.5	158.3
	1999	188.1	194.9	191.6
	2000	189.7	198.0	194.5

Table 8.

SEBBINS POND

BEDFORD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
BACK POND				
	1987	14	40	27
	1988	10	24	17
	1990	13	27	19
	1991	17	34	23
	1992	16	32	23
	1993	19	31	23
	1994	17	24	21
	1995	11	21	17
	1996	20	33	28
	1997	13	17	14
	1998	15	35	21
	1999	13	21	16
	2000	16	35	25
COVE INLET				
	1989	18	44	27
EPILIMNION				
	1987	19	27	23
	1988	12	21	15
	1989	5	27	17
	1990	14	24	18
	1991	13	16	14
	1992	12	18	14
	1993	14	29	19
	1994	13	16	14

Table 8.

SEBBINS POND

BEDFORD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1995	11	15	13
	1996	12	17	15
	1997	10	15	13
	1998	11	53	25
	1999	4	10	8
	2000	12	16	14
HYPOLIMNION				
	1987	105	135	120
	1988	56	76	66
	1989	64	87	72
	1990	55	81	65
	1991	47	125	89
	1992	46	57	53
	1993	44	70	60
	1994	33	55	42
	1995	31	51	38
	1996	27	51	37
	1997	44	79	60
	1998	33	58	48
	1999	39	89	56
	2000	23	40	31
METALIMNION				
	1987	34	44	39
	1988	14	32	21
	1989	31	31	31

Table 8.

SEBBINS POND

BEDFORD

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1990	23	37	32
	1991	15	29	22
	1992	17	19	18
	1994	18	39	25
	1995	17	23	19
	1996	19	36	28
	1997	15	27	20
	1998	27	41	34
	1999	8	15	12
OUTLET				
	1987	6	14	10
	1988	6	18	12
	1989	4	27	15
	1990	11	15	13
	1991	15	23	18
	1992	11	21	15
	1993	13	41	23
	1994	11	17	13
	1995	12	16	14
	1996	11	21	15
	1997	9	17	13
	1998	7	23	13
	1999	12	51	29
	2000	14	21	17

Table 9.

SEBBINS POND

BEDFORD

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
		June 16, 2000	
0.1	23.4	10.2	119.6
1.0	18.3	12.0	127.7
2.0	14.6	6.7	65.7
3.0	10.3	1.1	9.7
4.0	8.3	0.5	4.4
5.0	7.5	0.6	5.1

Table 10.

SEBBINS POND

BEDFORD

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
July 10, 1987	6.0	7.0	0.8	6.0
June 24, 1988	5.5	8.0	-0.5	-3.0
June 9, 1989	5.0	8.5	0.0	0.0
June 22, 1990	5.0	6.9	0.8	6.5
June 14, 1991	5.0	9.0	0.2	1.7
June 19, 1992	5.5	7.3	0.3	2.5
August 21, 1992	5.5	9.2	0.1	0.9
June 11, 1993	5.5	6.8	0.1	1.0
June 24, 1994	5.5	7.1	0.5	4.0
June 16, 1995	6.0	10.0	0.5	4.0
June 14, 1996	5.5	7.5	0.3	2.0
June 13, 1997	6.0	8.7	0.3	3.0
June 19, 1998	5.0	8.2	1.0	9.0
June 18, 1999	5.0	9.6	0.9	7.6
June 16, 2000	5.0	7.5	0.6	5.1

Table 11.

SEBBINS POND

BEDFORD

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
BACK POND				
	1997	0.4	0.5	0.4
	1998	0.3	1.3	0.8
	1999	0.5	0.9	0.7
	2000	0.3	0.8	0.5
EPILIMNION				
	1997	0.3	0.5	0.4
	1998	0.4	1.8	0.9
	1999	0.4	1.0	0.8
	2000	0.5	0.5	0.5
HYPOLIMNION				
	1997	1.6	2.9	2.2
	1998	2.1	13.7	6.9
	1999	2.3	11.1	5.1
	2000	0.8	1.1	0.9
METALIMNION				
	1997	0.4	1.6	0.9
	1998	0.7	2.2	1.6
	1999	0.4	1.2	0.9
OUTLET				
	1997	0.3	0.5	0.4
	1998	0.3	0.9	0.7
	1999	1.0	3.4	2.1
	2000	0.5	0.7	0.6